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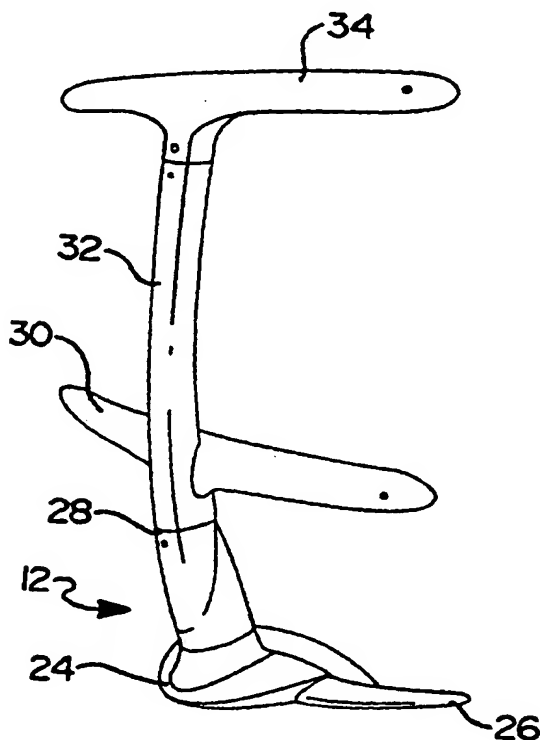
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[Continued on next page]

(54) Title: MODULAR LCD DISPLAY SYSTEM



(57) Abstract: A modular multi-screen LCD display system. In one embodiment the display system comprises four independent LCD screens (16-20) supported on first and second independent T-shaped support arms (30, 34). The first T-shaped support arm (30) is supported by a base assembly (12), and the second T-shaped support arm (34) is supported above the first T-shaped support arm by a vertical spacing arm (32). An adapter (80) is included which allows the display system to be reconfigured for use with a single LCD screen or with three LCD screens. In an alternative embodiment a central T-shaped support arm (106) is used to support two outer T-shaped support arms (108, 110) at opposite ends thereof. The outer T-shaped support arms are arranged vertically such that the three support arms form an "H" shape. A pair of LCD screens are mounted on each outer T-shaped support arm. This configuration permits four LCD screens to be mounted much closer to a work surface.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## MODULAR LCD DISPLAY SYSTEM

### Technical Field

This invention relates to display systems for computers, and more particularly to  
5 a modular, multi-screen display system for use with a computer system, where the  
multi-screen display system includes anywhere from one through four or more  
independent liquid crystal display screens disposed adjacently to one another on one  
or more support arms.

### Background of the Invention

10 Multi-screen displays are becoming more and more popular for use in various  
businesses, such as in financial institutions, stock market brokerage firms, engineering  
companies and the like. These displays are commonly coupled to a single computer  
and capable of displaying various graphs, charts and other important information  
simultaneously. Thus, a large amount of data or information can be displayed to the  
15 user at any given time, and without the user having to partially cover portions of the  
information in a "windowed" or layered arrangement, as would be necessary with only  
a single display screen.

Up until the present, most multi-screen display systems have been limited to  
two independent display screens positioned side-by-side. The angle of the screens  
20 relative to each other has usually not been adjustable, and often the displays have  
been required to be set directly on a table or desk, thereby using a significant amount  
of desk or table space. To date, there has not been a convenient and efficient means  
to provide three or more independent display screens, let alone to provide a modularly  
expandable display system which can be used to support four or more screens in a  
25 manner which minimizes the footprint area of the system, and which still allows each  
of the screens to be adjusted slightly such that each can be angled or "booked" toward  
each other to further enhance the ease with which information can be viewed on each  
of the screens.

It is therefore an object of the present invention to provide a display system for  
30 use with a computer system, where the display system incorporates four independent  
display screens supported on a pair of common horizontal support arms, and elevated  
by a support column, so as significantly reduce the footprint area required by the  
display system.

It is another object of the present invention to provide a display system for use with a computer system, where the display system incorporates four independent liquid crystal display (LCD) screens mounted on a pair of vertically disposed support arms. It is still another object of the present invention to provide a display system for use with a computer system, where the display system incorporates four independent LCD screens, and wherein each of the screens are capable of being angled or "booked" toward each other to optimize the viewing angle of the screens relative to the user.

It is still another object of the present invention to provide a display system which can be modularly configured to provide between one through four, or more, LCD display screens, through the use of an adapter, in a manner that does not require time consuming procedures to so modify the system.

#### SUMMARY OF THE INVENTION

The above objects are provided by a modular display system in accordance with preferred embodiments of the present invention. In one embodiment the display system comprises a base system, a vertical support arm, a first T-shaped support arm, a second T-shaped support arm, and an upper vertical spacing arm. The two T-shaped support arms each have a pair of display screen docking stations where a pair of liquid crystal display (LCD) screens can be secured to. Preferably, each docking station includes a ball joint assembly which permits its associated LCD screen to be angled or "booked" toward the user to thus optimize viewing thereof by the user. The second T-shaped support arm is supported above the first by the upper vertical spacing arm. The first T-shaped support arm includes a neck portion having a support member which fits within a recess in the vertical support arm.

In a preferred embodiment an adapter is provided which enables the entire display system to be reconfigured to be used with only a single LCD screen or with three LCD screens. The adapter has a support member adapted to engage within the recess of the vertical support member and a docking station for supporting an LCD screen, preferably via a ball joint interposed therebetween.

In yet another alternative preferred embodiment the display system of the present invention includes a central T-shaped support arm which supports at its

opposite ends thereof a pair of outer T-shaped support arms. Each of the outer T-shaped support arms has a docking station at its outermost end for supporting an LCD screen. Thus, each outer T-shaped support arm is able to support a pair of LCD screens thereon, and to present the LCD screens much closer to a surface on which the display system is resting.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The various advantages of the present invention will become apparent to one skilled in the art by reading the following specification and subjoined claims and by referencing the following drawings in which:

Figure 1 is a front view of a four LCD screen display system in accordance with a preferred embodiment of the present invention.

Figure 2 is a front perspective view of the four LCD screen display system of Figure 1 but without the LCD screens attached;

Figure 3 is a rear perspective view of the system shown in Figure 2;

Figure 4 is a side perspective view of the system shown in Figure 2;

Figure 5 is a perspective view of the display system of Figure 2 in a disassembled state so as to more clearly illustrate its various components;

Figure 6 is a perspective view of the display system of Figure 2 with the two T-shaped support arms ready to be attached to each other and to the vertical support arm;

Figure 7 is a rear view of the adapter of the present invention used to convert the display system from a four screen system to a one screen system;

Figure 8 is a side view of the adapter of Figure 7;

Figure 9 is a perspective view of the adapter disposed adjacent the vertical support column ready for attachment thereto;

Figure 10 is a top perspective view of the adapter secured to the vertical support column;

Figure 11 is a front perspective view of the adapter of Figure 10;

Figure 12 is a rear perspective view of the adapter of Figure 10;

Figure 13 is a rear perspective view of a single screen LCD display system in accordance with the present invention configured with the use of the adapter of

Figures 7 and 8;

Figure 14 is a front perspective view of an alternative preferred embodiment of the present invention;

Figure 15 is a front perspective view of the display system shown in Figure 14  
5 but without the LCD screens attached thereto;

Figure 16 is a rear perspective view of the display system shown in Figure 15;

Figure 17 is a side perspective view of the display system shown in Figure 15;  
and;

Figure 18 is a view of the various components of the support system of Figure  
10 15 positioned for attachment to one another;

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, there is shown a four screen liquid crystal display (LCD) display system 10 in accordance with a preferred embodiment of the present invention. The display system 10 includes a base assembly 12 which supports all four  
15 screens 14, 16, 18 and 20 in an elevated manner above a work surface 22. The base assembly 12 includes a base member 24 having a pair of support feet 26 extending outwardly therefrom and a vertical support column 28 fixedly secured thereto. The base member 24 preferably includes a heavy piece of material, such as lead, which is insert molded or otherwise attached thereto to provide resistance against tipping or  
20 leaning of the display system 10.

Referring to Figures 2- 4, the display system 10 can be seen without the LCD screens 14-20 secured thereto. A first T-shaped support arm 30 is fixedly secured to the vertical support column 28. An upper vertical spacing arm 32 is secured at one end to the first T-shaped support arm 30 and at its opposite end to a second T-shaped  
25 support arm 34. The first T-shaped support arm includes a pair of docking stations 34a and 34b to which suitable ball joints (not shown) are preferably attached. The ball joints are then secured to the rear of the LCD screens 14 and 16, respectively. Similarly, the second T-shaped support arm 34 includes docking stations 34a and 34b. A pair of ball joints are preferably secured to the docking stations 30a and 30b and to  
30 the rear portion of LCD screens 18 and 20, respectively.

With specific reference to Figures 3 and 4, it will be noted that the T-shaped

support arms 30 and 34 each are "bowed" or arched slightly. The radius of curvature is preferably within a range of about 24" - 36", and more preferably about 30", which has been found to ergonomically maximize the convenience to the user in viewing the LCD screens. This enables the two LCD screens disposed thereon to be presented in a slightly "booked" fashion (i.e., angled towards each other slightly) to ease viewing of the screens. The ball joints enable an added degree of adjustability in optimizing the viewing angle of each screen, but it will be understood that the ball joints are optional. One such ball joint 33 is shown in simplified form in Figure 4.

From Figures 3 and 4 it will be noted that the vertical support column and the upper vertical spacing arm 32 together form a slightly curving structure. This further helps to optimize the stability of the overall support system 12.

Referring now to Figure 5, the display system 10 can be seen without the LCD screens 14-20 and without the base member 24 attached thereto. The first T-shaped support arm 30 includes a support member 36 projecting therefrom and a recess 38 formed within a neck portion 40 thereof. The support member 36 includes apertures 42 and 44, while the neck portion 40 includes an aperture 46. The second T-shaped support arm 34 is essentially identical in construction and includes a projecting support member 48 and a recess 50 formed in a neck portion 52 thereof. The support member 48 includes apertures 54 and 56 while the neck portion 52 includes an aperture 58.

Referring further to Figure 5, the vertical support column 28 also includes a support member 60 and a recess 62 adjacent the support member. The support member 60 includes an aperture 64. The recess 62 is adapted to receive the support member 36, while recess 38 receives the support member 60 therein when the first T-shaped support arm 30 is secured to the vertical support column 28.

The upper vertical spacing arm 32 includes at a lower end portion a curving attachment portion 66 and an aperture 68, and at an opposite end a support member 70 having an aperture 72. A recess 74 is also formed adjacent the support member 70 and adapted to receive the support member 54 of the second T-shaped support arm 34, while the support member 70 engages within the recess 50 in the T-shaped support arm 34. A cover 76 having a plurality of apertures 78 is attachable to the

vertical support column 28 and to the upper vertical spacing arm 32.

Referring to Figure 6, the components just described in connection with Figure 5 are shown disposed in position to be secured together by a suitable number of external fastening elements (not shown) such as threaded fasteners placed in the  
5 apertures 42, 44, 46, 54, 56, 58, 64, 68, 72 and 78.

Referring now to Figures 7-12, an adapter 80 is shown for enabling the display system 10 to be configured for use with only a single LCD screen, or for modifying the display system 10 to be used with only three LCD screens. The adapter 80 includes a recess 82 and a docking station 84. A pair of apertures 86 and 88 are also formed for  
10 enabling external fastening elements to be used to secure the adapter to either the vertical support column 28 or to the upper end 32a (Figure 6) of the upper vertical spacing arm 32. By removing the second T-shaped support arm 34 and securing the adapter 80 to the upper end 32a, the display system 10 can be configured to support three LCD screens instead of four, and without requiring any modification to the  
15 placement of the two LCD screens mounted on the first T-shaped support arm 30. Alternatively, the display system 10 could be easily converted to use as a single LCD screen system by removing the first T-shaped support arm 30 and the other support arms attached thereto, and attaching the adapter 80 directly to the vertical support column 28 such that the support member 60 is received in recess 82. Thus, the  
20 adapter 80 allows the display system 10 to be altered, in a modular fashion, to reconfigure the system 10 for use as a single or triple LCD screen display system. The single screen configuration, using the adapter 80, is shown in Figure 13. It will also be appreciated that the docking station 84 will preferably incorporate a suitable ball joint for permitting adjustment of its LCD screen attached thereto.

25 Referring now to Figure 14, a four screen LCD display system 100 in accordance with an alternative preferred embodiment of the present invention is shown. This embodiment is somewhat similar to the display system 10 and also makes use of a base assembly 102 having a vertical support column 104 for supporting the four LCD screens 14-20. The principal advantage of the system 100 is  
30 that it is able to support the screens 14-20 much closer to the surface 22 on which the base assembly 102 rests.



Referring to Figures 15-17, the vertical support column can be seen to be secured to a central, T-shaped support arm 106. The opposite ends 106a and 106b of the support arm 106 are in turn secured to outer T-shaped support arms 108 and 110.

The resulting structure forms a somewhat "H" shape that presents the four LCD screens 14-20 much closer to the surface 22 on which the system 100 is supported. It will be appreciated that the base assembly 102 and its vertical support column 104 are identical to the base assembly 12 and support column 28 of the system 10 described previously. The support arms 106, 108 and 110 also each incorporate recesses and mounting members identical to those of the system 10 as shown in Figures 5 and 6 and described herein.

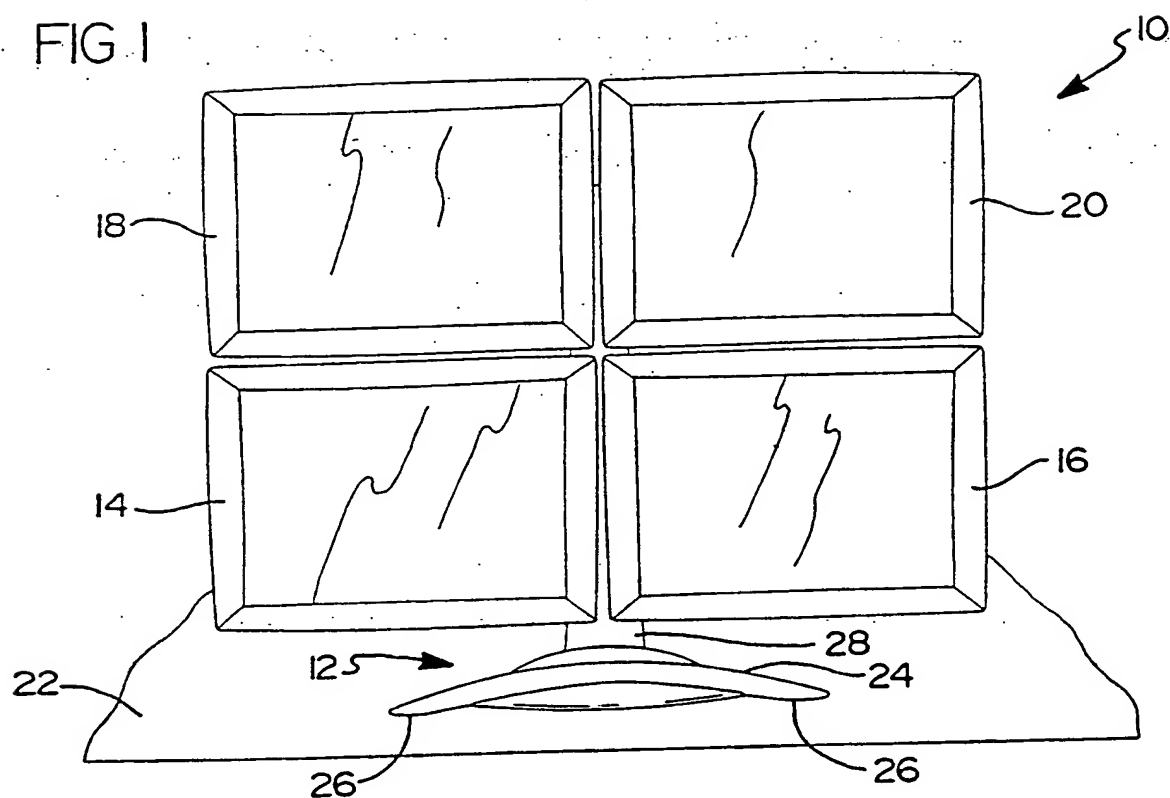
The apparatus of the present invention thus provides a modularly configurable LCD display system. The system can be configured for one, two, three, four or even more LCD screens. Obviously, more than four screens may require enlargement of the base assembly 12 or 102 to ensure stability.

Those skilled in the art can now appreciate from the foregoing description that the broad teachings of the present invention can be implemented in a variety of forms. Therefore, while this invention has been described in connection with particular examples thereof, the true scope of the invention should not be so limited since other modifications will become apparent to the skilled practitioner upon a study of the drawings, specification and following claims.

## CLAIMS

1. A Modular liquid crystal display (LCD) screen system comprising:
  - a base assembly;
  - a first T-shaped support arm supported by said base for supporting a pair of
  - 5 LCD screens adjacent one another above a support surface;
  - a second T-shaped support arm for supporting a second pair of LCD screens adjacent each other;
  - a vertical support arm for supporting said second T-shaped support arm on said base assembly above said first T-shaped support arm; and
  - 10 wherein said vertical support arm and said second T-shaped support arm are removable from said base assembly to allow said modular LCD screen system to be easily configured as a two LCD screen or a four LCD screen display system.

FIG. 1



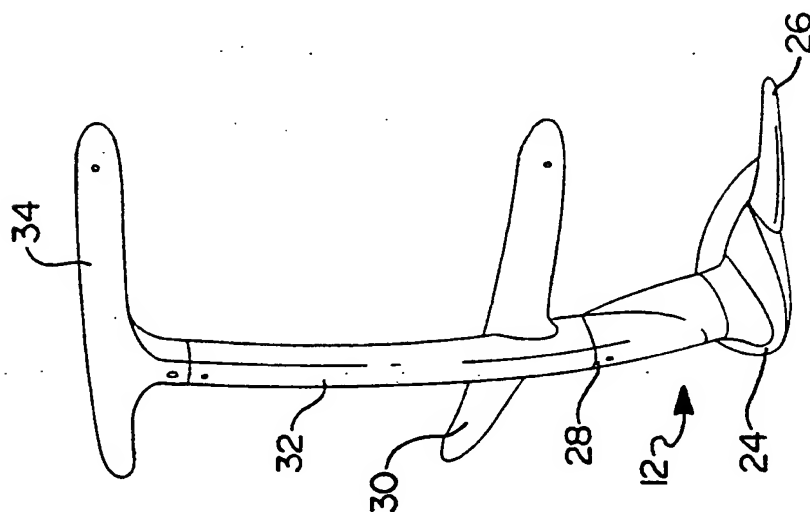
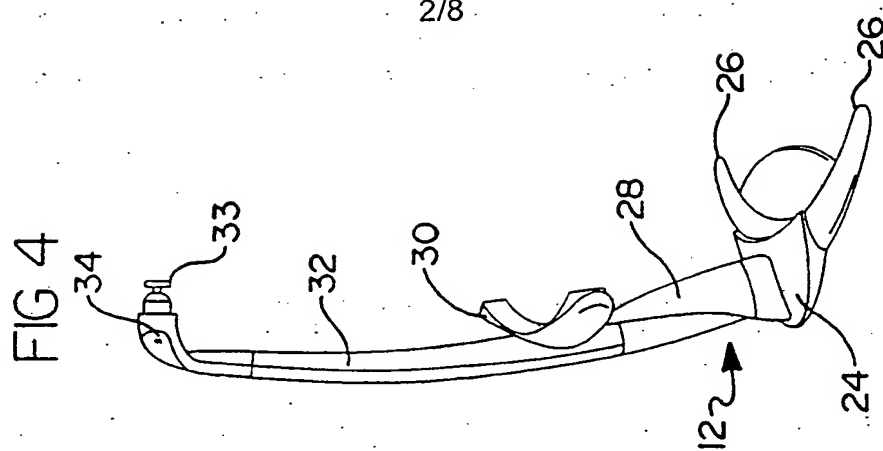
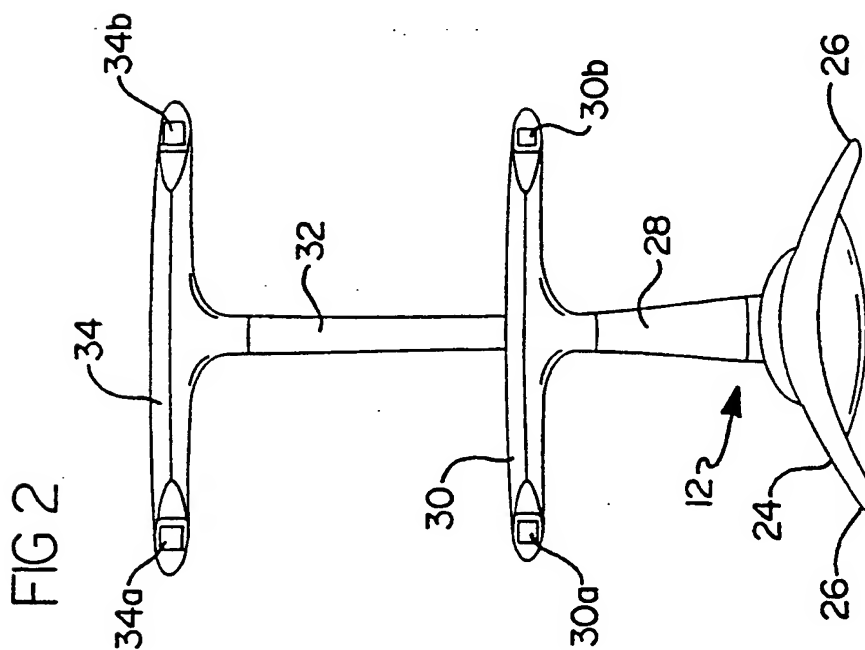


FIG 3



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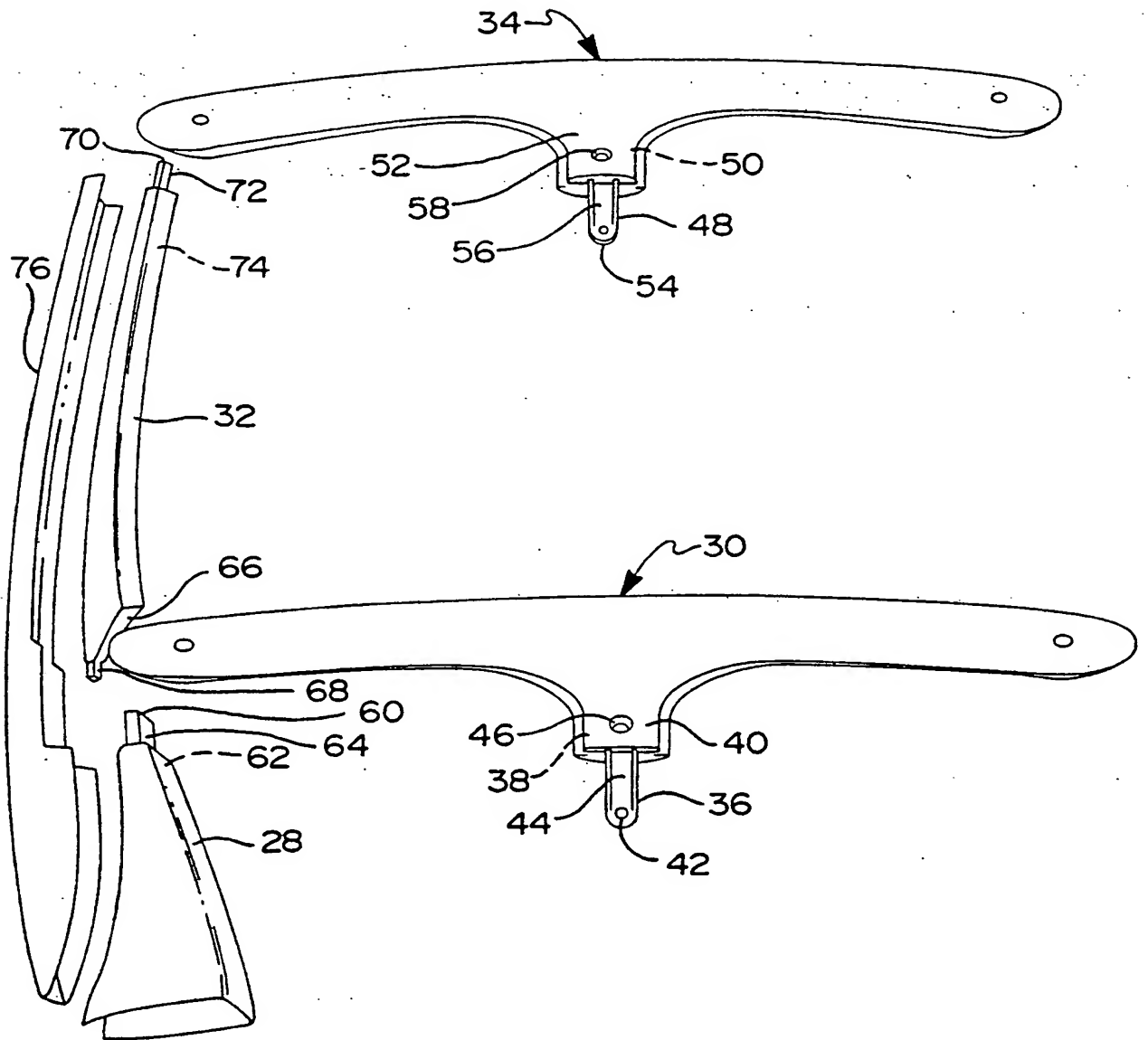


FIG 5

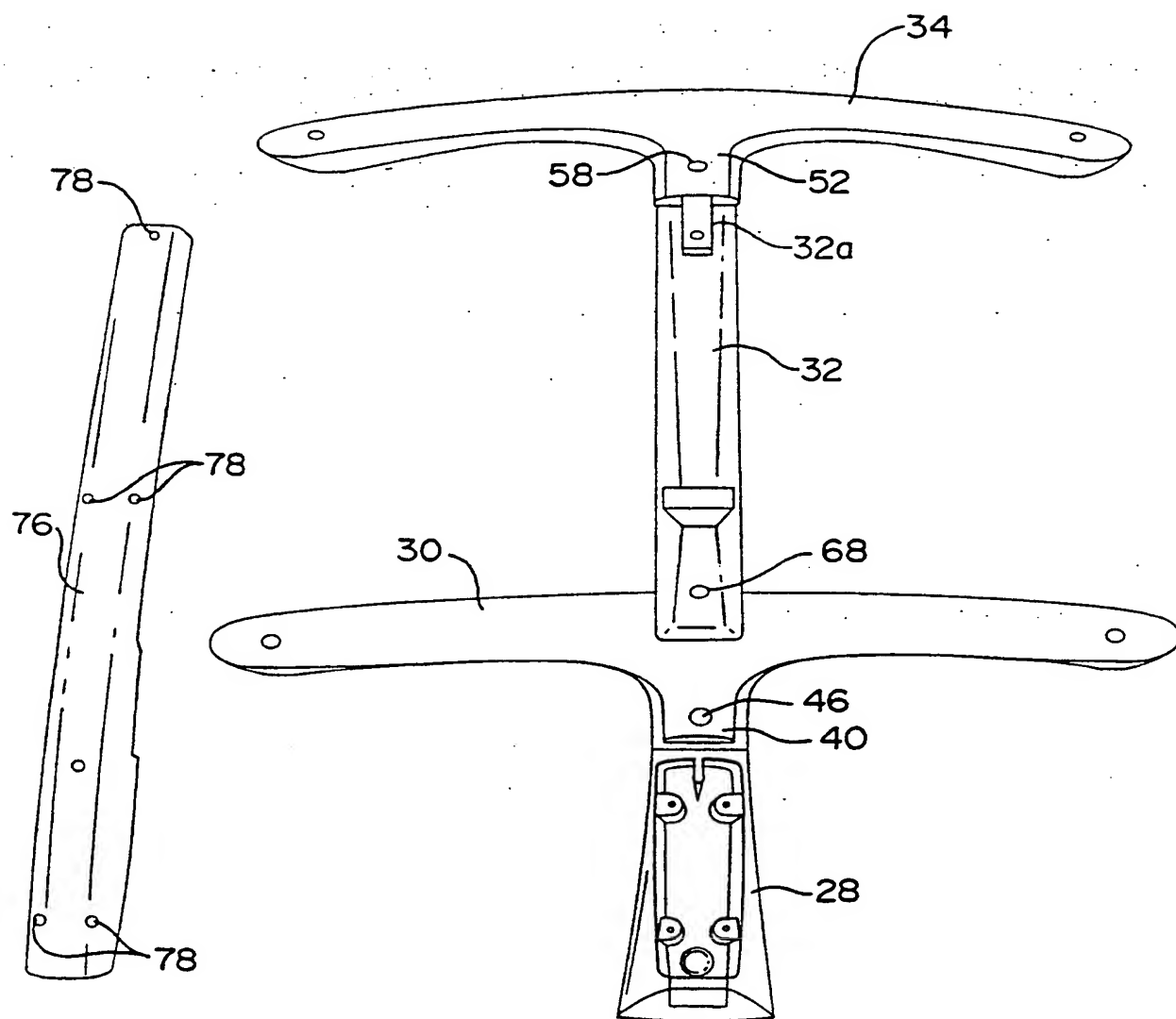
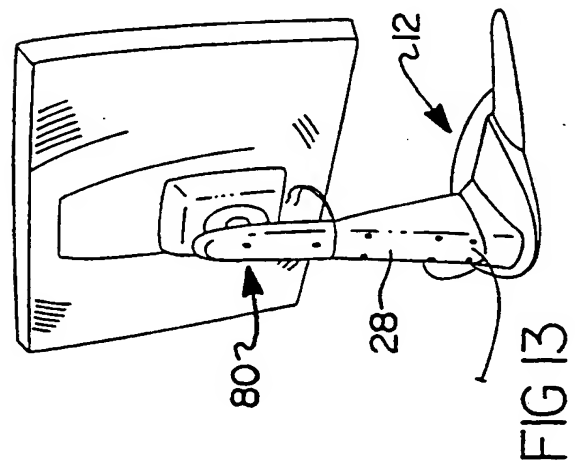
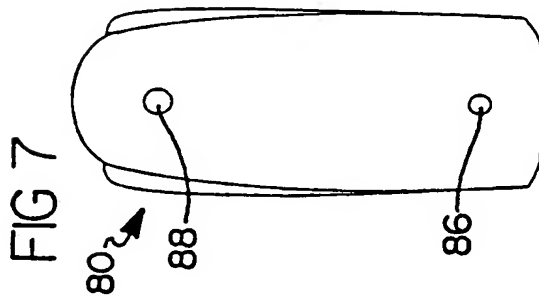
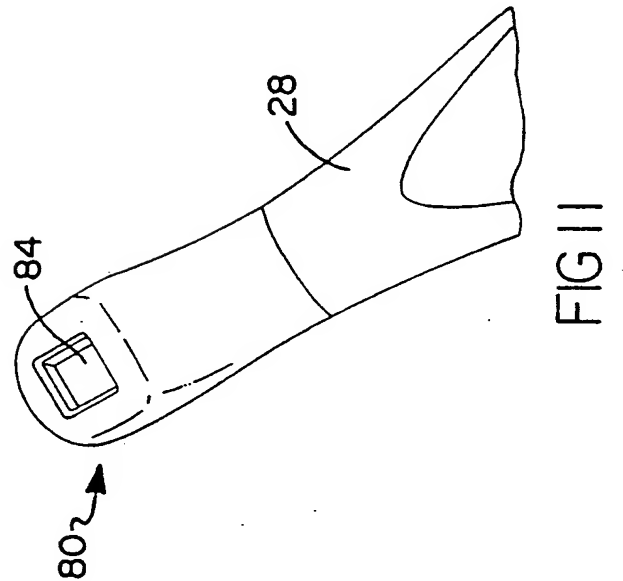
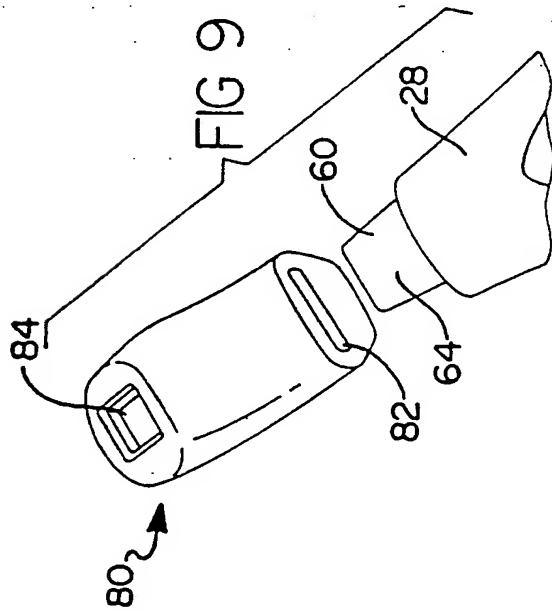
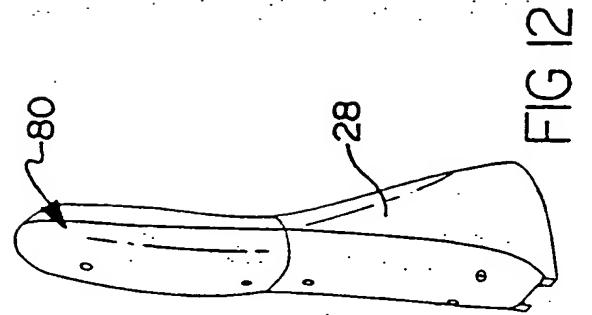
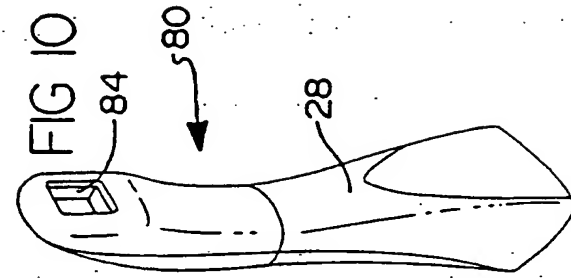
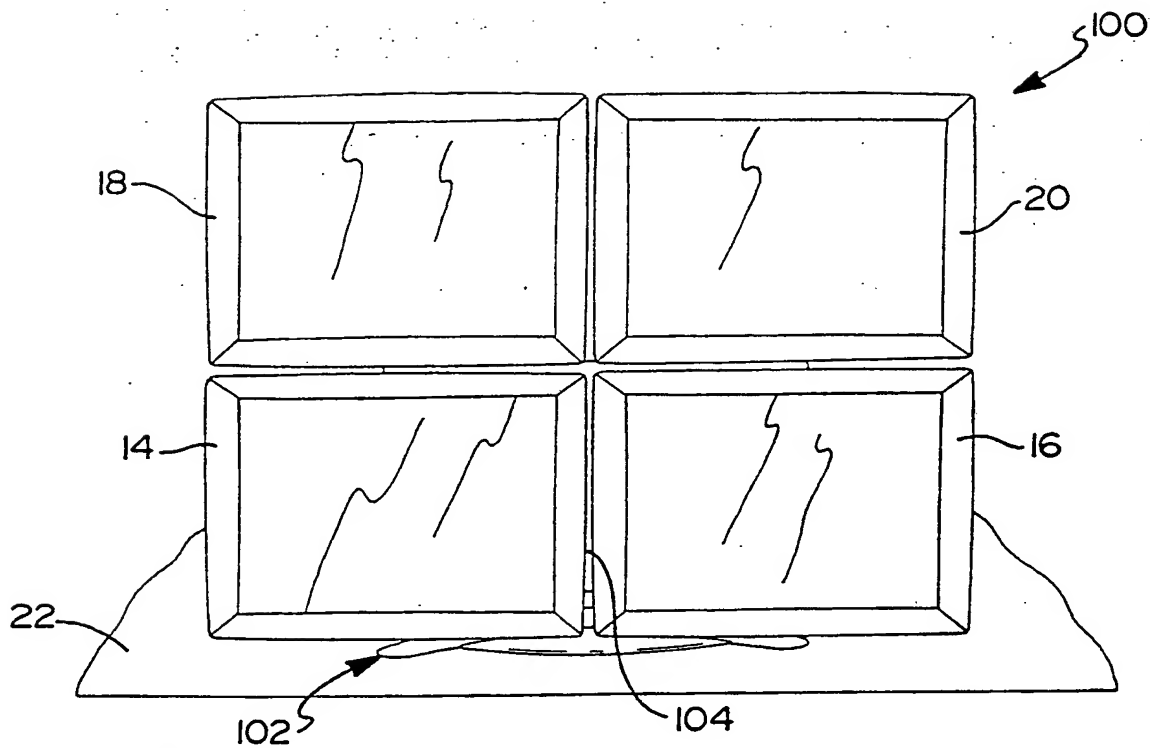


FIG 6







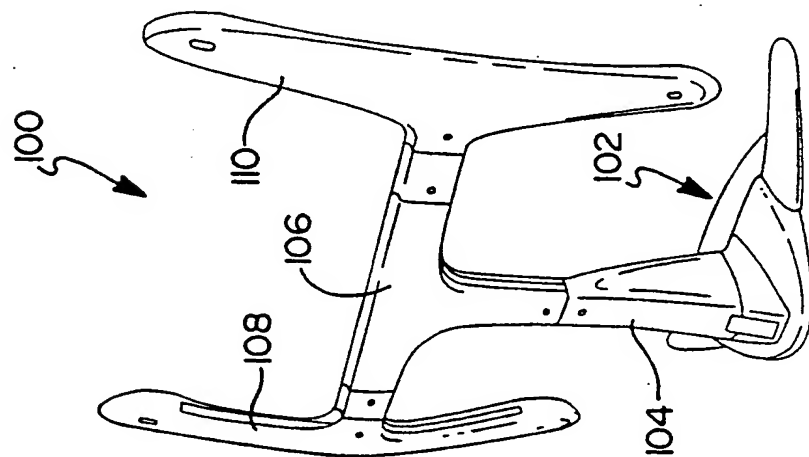
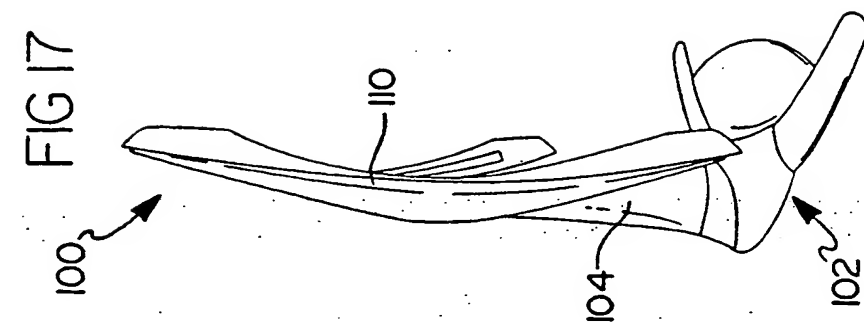
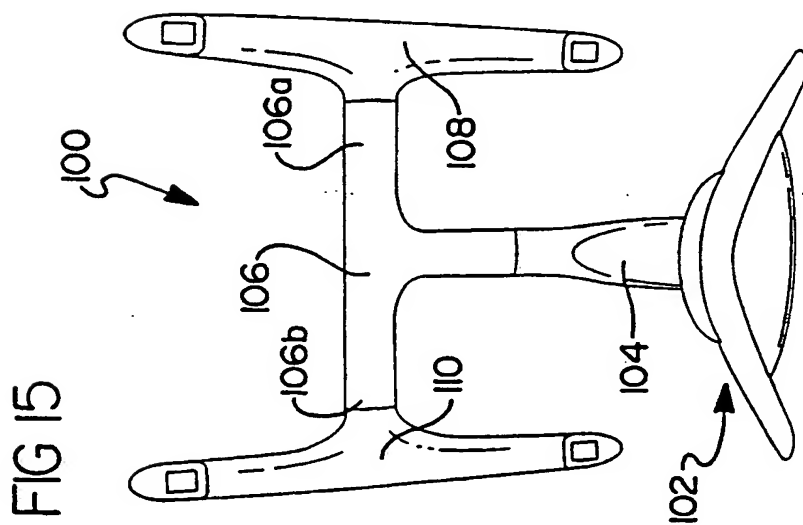


FIG 16



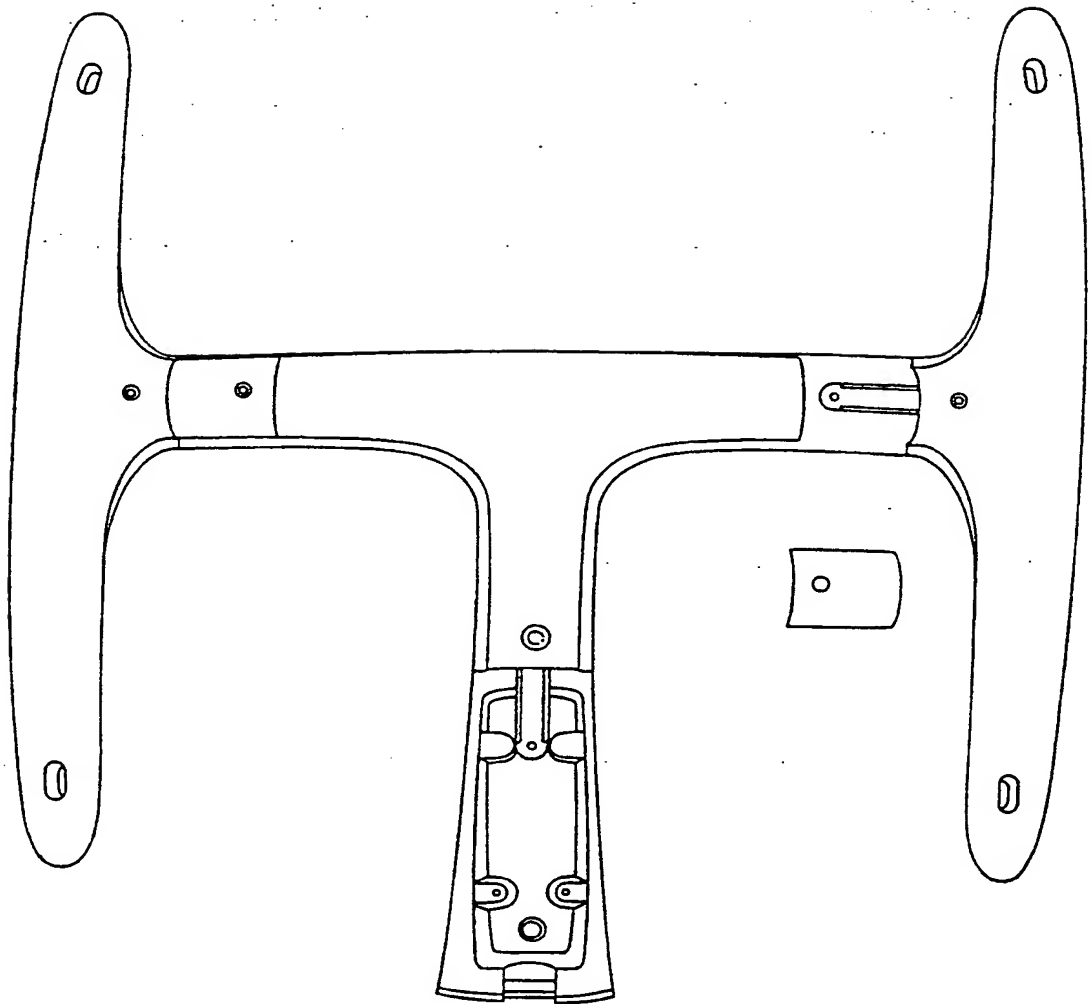


FIG 18

## INTERNATIONAL SEARCH REPORT

International Application No.

PC1/IB 00/01641

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F1/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06F G09F F16M A47B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, EPO-Internal, PAJ, IBM-TDB, INSPEC, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 537 127 A (JINGU MASAHARU) 16 July 1996 (1996-07-16) the whole document	1
P, A	WO 00 39493 A (CHUNG SON ; HALL IAN C (CA); MOSCOVITCH JERRY (CA); ELCHUK MARK D ( ) 6 July 2000 (2000-07-06) page 24, line 32 -page 26, line 16; figures 53-57, 63	1

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

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Date of the actual completion of the international search

9 February 2001

Date of mailing of the international search report

15/02/2001

Name and mailing address of the ISA

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 00/01641

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5537127 A	16-07-1996	JP 6014886 A JP 6237903 A	25-01-1994 30-08-1994
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